

**LIFE HISTORY AND DESCRIPTIONS OF IMMATURES
OF THE DICTYOPHARID PLANTHOPPER
PHYLLOSCELIS PALLESCENS
(HOMOPTERA: FULGOROIDEA)**

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Abstract.—The life history of *Phylloscelis pallescens* Germar in Missouri is summarized and the egg and nymphs are described and illustrated. *P. pallescens* is univoltine, has five nymphal instars and apparently overwinters as eggs. This dictyopharid planthopper feeds exclusively on slender mountain mint [*Pycnanthemum tenuifolium* Schrad. (Lamiaceae)]. Nymphal instars can be separated by body size, number of pit-like sensoria, size of wing pads, metatibia and tarsomere spination, and number of metatarsomeres.

The four species of the dictyopharid planthopper genus *Phylloscelis* are widely distributed in the eastern and central United States (McPherson and Wilson, in press). The genus has been revised recently and the morphology of adults of each of the species illustrated and described (McPherson and Wilson, in press). One of the species, *P. rubra* Ball, was considered a pest of cranberry [*Vaccinium macrocarpon* Aiton (Ericaceae)], its biology on that host was studied in detail, and the immature stages described (Scammell, 1917; Serrine and Fulton, 1914). Little is known about the biology of the other species of *Phylloscelis*.

Phylloscelis rubra is univoltine and laid the overwintering eggs from early September to the middle of October under their cranberry host plants (Ball, 1930; Scammell, 1917; Serrine and Fulton, 1914). Ball (1930) recorded nymphs and adults feeding exclusively on *Lyonia fruticosa* (Michx.) G. Torr. ex B. L. Robinson (Ericaceae), while Serrine and Fulton (1914) and Scammell (1917) found nymphs and adults feeding only on cranberry.

Phylloscelis atra Germar has been found feeding on a number of species of ericaceous shrubs in Florida (Ball, 1930), and *Coreopsis palmata* Nutt. (Asteraceae) in Missouri (Wilson, pers. comm.). Florida populations are bivoltine; the first generation is found from May to July, and the second generation from August to October; the eggs are the overwintering stage (Ball, 1930). *P. atra* occurs in three color morphs, one of which, "var." *albovenosa*, has pale yellow stripes on the black forewings. Hamilton (pers. comm.) notes that this color pattern is very similar to that of a presumably toxic leaf beetle (*Cryptocephala* sp.; Coleoptera: Chrysomelidae) he found at the same collecting site in Michigan.

Phylloscelis pennata Ball is known only from southwestern Texas (Ball, 1937). No biological information is available for this species.

Phylloscelis pallescens Germar ranges from Massachusetts and southern Ontario, south to northwestern Florida, and west to Iowa, Missouri, and Texas (Hamilton,

pers. comm.; Wilson and McPherson, 1980; Wilson et al., 1993b). This species has been recorded from cranberry bogs (Smith, 1910, in Serrine and Fulton, 1914), a single specimen from a species of *Andromeda* (Ericaceae) in Florida (Ball, 1930), and numerous specimens from slender mountain mint [*Pycnanthemum tenuifolium* Schrad. (Lamiaceae)] in Missouri (Wilson et al., 1993b).

This study presents information on the life history of *P. pallescens* in Missouri, descriptions and illustrations of the egg and nymphal stages, and a key for separating the nymphal instars.

MATERIALS AND METHODS

Field Study. *P. pallescens* was first collected from its host plant, slender mountain mint, during the summer of 1990 at Paintbrush Prairie, Pettis Co., Missouri (Wilson et al., 1993b). Field collections were made with a modified Weedeater® leaf blower (Wilson et al., 1993c) from pure stands of *P. tenuifolium* weekly from 30 April to 15 October 1991 at various sites in Johnson and Pettis Counties, Missouri. Specimens were placed in an ethyl acetate charged killing jar, stored in 70% isopropyl alcohol, then brought back to the laboratory.

Descriptions of Immatures. Descriptions were based on 10 specimens, where possible. The 5th instar nymph is described in detail, with only major differences noted for earlier stages. Measurements are given in mm as mean \pm SD. Length is measured from the apex of the vertex to the apex of the abdomen, width across the widest part of the body, and thoracic length along the mid-line from the anterior margin of the pronotum to the posterior margin of the metanotum. Eggs were obtained from field collected gravid females reared in plastic petri dishes lined with moist filter paper and with host plant clippings for feeding. Adult females were maintained in the laboratory under a 12:12 photoperiod at ca. 23°C until oviposition (usually within 48 hr after collection). Eggs were stored in 70% isopropyl alcohol. Descriptions of nymphs are based on the following field-collected specimens (I–V = nymphal instars, ♂ and ♀ = adults): MISSOURI: Johnson Co., Knob Noster State Park, K. R. McPherson collector, 4 July 1991 (1—I, 10—II, 12—III, 5—IV, 1—V), 12 July 1991 (1—III, 9—IV, 2—V), 16 July 1991 (2—III, 1—IV, 5—V), 11 September 1991 (2♂); Johnson Co., BB Hwy 0.5 mi. S of Warrensburg (Belshe farm), K. R. McPherson collector, 17 June 1991 (5—I, 5—II, 2—III, 1—IV), 24 June 1991 (1—III, 1—IV), 8 July 1991 (1—III, 5—IV), 18 July 1991 (4—IV, 8—V), 2 August 1991 (2—V, 2♂, 2♀), 13 September 1991 (1♂, 2♀); Pettis Co., Paintbrush Prairie, 9 mi. S Sedalia, S. W. Wilson collector, 10 August 1991 (2—V, 2♂), 16 August 1991 (1—V, 5♂, 1♀), 23 August 1991 (10♂, 6♀), K. R. McPherson collector, 17 September 1991 (1♂, 3♀), all specimens collected from *P. tenuifolium*.

RESULTS AND DISCUSSION

Field Study. No specimens were collected during April or May. Nymphal instars first appeared on 6 June with adults appearing on 2 August. *P. pallescens* is univoltine, and overwinters as eggs (Fig. 1). This is supported by the absence of overwintering adults or immatures in collected samples, and the presence of gravid females in collected samples during early fall.

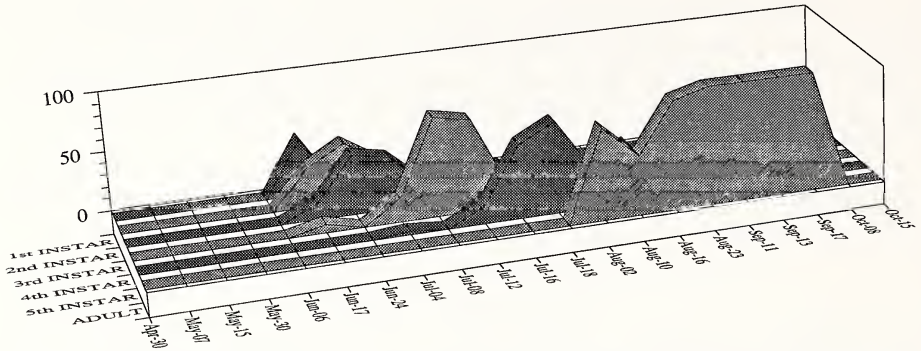


Fig. 1. Seasonal occurrence of *Phylloscelis pallescens*. Number of individuals of each stage is expressed as percentage of total observations of that stage per collecting date (N = 124; e.g., 1 third and 1 fourth instar were collected on 24 June—50% third and 50% fourth instars on that date).

This species was collected exclusively from slender mountain mint. Nymphs and adults fed on the stems of the host plant ca. 20 cm above ground level. During feeding, large amounts of wax were emitted from the abdominal waxpads of all developmental stages. This made it easy to identify, from some distance, active feeding sites and host plants. With careful maneuvering, specimens could be approached closely enough to allow collecting with an aspirator. Attempts to collect or observe this species feeding on other host plant species were unsuccessful. We believe *P. pallescens* to be host plant specific on *P. tenuifolium* in Missouri. The ranges of *P. pallescens* and *P. tenuifolium* correspond (Barkley, 1977; Grant and Epling, 1943; Wilson and McPherson, 1980; Seymour, 1969), except for specimens of *P. pallescens* from northeastern Florida (Nassau Co.) (McPherson and Wilson, in press; O'Brien, pers. comm.) where it might occur on *Pycnanthemum nudum* Nutt., which has been collected in the same county, or *P. floridanum* Grant and Epling, which has been collected in nearby counties (Judd, pers. comm.). This host plant preference corresponds to that of other dictyopharids, most of which are monophagous on dicots (Wilson et al., 1993a).

Descriptions of Immatures

Fifth Instar (Figs. 2, 3, 5). Length 3.27 ± 0.03 ; thoracic length 2.03 ± 0.01 ; width 2.63 ± 0.02 . N = 10.

Form subcylindrical, convex dorsally, slightly flattened dorsoventrally, widest across mesothoracic wingpads; light to dark brown, heavily marked with cream spots.

Vertex ca. 2× broader than long, lateral margins carinate, triangular, anteromedially meeting carinae of frons; posterior margin obscured by anterior margin of pronotum. Frons 2× longer than wide, dorsal margin convex, lateral margins weakly convex and carinate (outer carinae) roughly paralleled by inner carina on each side, with median longitudinal carina; juncture with clypeus slightly concave; ca. 32 pits, most corresponding with pale spots, between each inner and outer carina. Clypeus

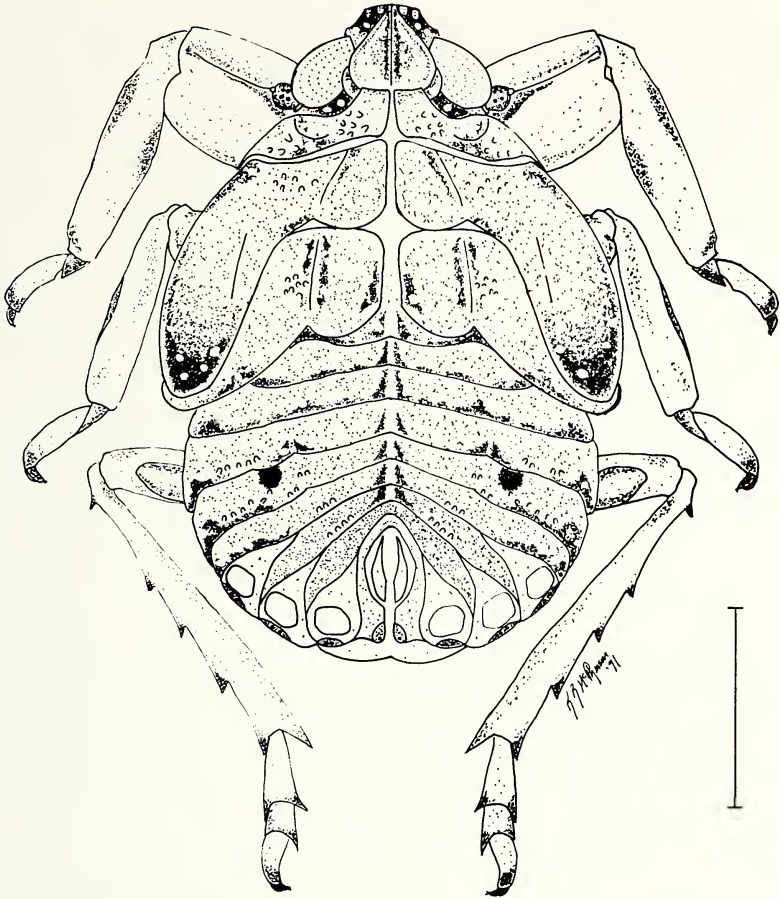


Fig. 2. *Phylloscelis pallescens* fifth instar, dorsal view. Bar = 1 mm.

consisting of a conical basal anteclypeus and a conical distal postclypeus, both slightly flattened laterally, medially carinate, lateral margins carinate; anteclypeus medium brown with 4 regular rows of cream spots, each row containing 4–5 spots; postclypeus dark brown with cream spots. Beak 3-segmented, extending to metacoxae; segment 1 obscured by postclypeus, segment 2 ca. $1.5\times$ longer than segment 3, segments 1 and 2 cream colored, segment 3 cream colored with distal $\frac{1}{3}$ sharply changing to dark brown. Eyes reddish with pale stripes. Antennae 3-segmented, scape short and ringlike; pedicel subcylindrical, ca. $\frac{1}{4}\times$ size of eye; pedicel with 19–21 pits, 3 rows of 4 pits each visible from ventral view and 4 rows of 2 pits each visible in dorsal view, occasionally a pit present outside of the rows; flagellum whiplike distally, bulbous base ca. $\frac{1}{4}\times$ length of pedicel.

Thoracic nota divided by longitudinal mid-dorsal line into 3 pairs of plates. Pronotal anterior margin straight, carinate in middle, curving posterolaterally, posterior margin sinuate; each plate with 2 irregular rows of pits usually corre-

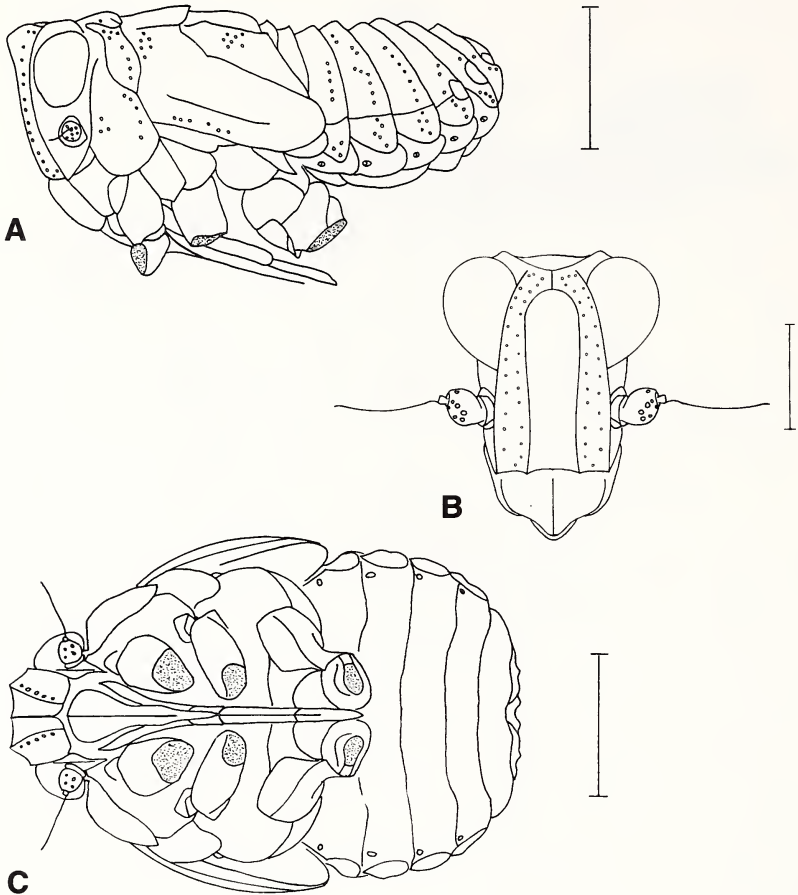


Fig. 3. *Phylloscelis pallescens* fifth instar. A. Left lateral view. B. Frontal view. C. Ventral view. Bars = 1 mm.

sponding with cream spots, totaling ca. 23 pits (lateralmost pits not visible in dorsal view). Mesonotal median length $2\times$ that of pronotum; each plate with carina originating on anterior margin in median $\frac{1}{4}$ and extending posterolaterally to posterior margin; cluster of 4 pits just lateral to carina and 3–4 pits on wing pad; wingpad lobate, extending nearly to apex of metanotal wingpad. Metanotal median length ca. $0.8\times$ that of mesonotum; each plate with longitudinal carina originating on anterior margin as an extension of mesonotum carina; cluster of 8 pits just lateral to carina; wingpad broadly lobate; extending laterally to anterior margin of tergite 3. Pro- and mesocoxae short, triangular in cross section, posterolaterally directed; procoxae with elevated, longitudinal carina on the lateral aspect. Mesocoxae carinate, less prominent than procoxae. Metacoxae fused to sternum. Profemora greatly foliose laterally, subtriangular in cross-section. Meso- and metafemora only slightly foliose, less strongly carinate than profemora. Pro-

and mesotibia subtriangular in cross-section, each corner with a lateral carina; metatibiae slightly flattened and subtriangular in cross-section, longitudinal row of 4 lateral spines on shaft, and a transverse apical row of 8–9 spines (generally 8) on plantar surface. Pro- and mesotarsi each with 2 tarsomeres; tarsomere 1 wedge-shaped; tarsomere 2 subcylindrical and curved. Metatarsi each with 3 subcylindrical tarsomeres; tarsomere 1 with transverse apical row of 10–12 spines (generally 11) apically on plantar surface; tarsomere 2 with apical row of 7–8 spines (generally 8) on plantar surface; tarsomere 3 similar to terminal tarsomere of other legs. All legs with terminal pair of dark brown curved claws and a clear, membranous, lobate, median pulvillus.

Abdomen 9 segmented, subcylindrical in cross-section, slightly flattened dorso-ventrally, widest across tergite 4; tergites 7–9 telescoped anteriorly, tergites 6–8 each with oval dark cream caudal waxpads. Tergite 9 elongate vertically, surrounding anus, with 1 pit on each side; posteriormost margin with brown bulbous protrusion on either side of midline. Tergites 2–7 each with a weak median longitudinal carina. Each tergite with the following number of pits on either side of midline (lateralmost pits not visible in dorsal view due to curving of tergites onto ventral aspect): tergite 3 with 1–2 pits, tergites 4–5 each with 12 pits, tergite 6 with 10 pits, tergite 7 with 8 pits, tergite 8 with 6 pits, and tergite 9 with 1 pit. Tergite 5 with a pair of dark brown spots on either side, ca. $\frac{1}{2} \times$ distance from midline to lateral edge.

Fourth Instar (Figs. 4A, 5). Length 2.47 ± 0.03 ; thoracic length 1.16 ± 0.02 ; width 1.50 ± 0.02 . $N = 10$.

Frons with ca. 28 pits between each inner and outer carina. Anteclypeus with 3 regular rows of cream spots, each row containing 3 spots. Antennal pedicel with 12–14 pits, 2 rows of 3 pits visible in ventral view, and scatter of pits with no discernible pattern visible in dorsal view.

Pronotal plates each with ca. 19–20 pits in 2 irregular rows, ventrolateral surface with 7–8 pits in an irregular pattern. Mesonotal plates each with 4 pits just lateral to carina and 5 pits on wingpad. Wingpad broadly lobate, covering $\frac{1}{3}$ of metanotal wingpad laterally. Metanotum with cluster of 5 pits just lateral to carina, wingpad with 2 pits in lateral $\frac{1}{3}$. Profemora and protibiae less foliose. Metatarsomere 1 with apical transverse row of 9–10 spines (generally 9) on plantar surface. Metatarsomere 2 with transverse apical row of 5 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline (lateralmost pits not visible in dorsal view): tergite 4 with 10 pits, 5 with 11 pits, 6 with 8 pits, 7 with 7 pits, and 8 with 3 pits, tergite 9 with 1 pit.

Third Instar (Figs. 4B, 5). Length 2.38 ± 0.03 ; thoracic length 1.01 ± 0.02 ; width 1.27 ± 0.02 . $N = 10$.

Vertex ca. $1.5 \times$ broader than long. Frons $3 \times$ longer than wide. Anteclypeus with few to no distinguishable cream spots. Antennal pedicel with 7–8 pits.

Pronotal plates each with ca. 17–18 pits in 2 irregular rows, ventrolateral surface with ca. 8 pits. Mesonotal wing pad with 3 pits; wingpad lobate, covering $\frac{1}{4}$ of metanotal wingpad laterally. Metanotum on each side with cluster of 4 pits just lateral to carina; wingpad with 1 pit. Profemora and protibiae less foliose. Metatibia with an apical transverse row of 7 spines on plantar surface. Metatarsi with 2 tarsomeres; tarsomere 2 cylindrical with an apical transverse row of 8 spines on plantar surface; tarsomere 1 with transverse apical row of 2 to 3 spines (generally 3).

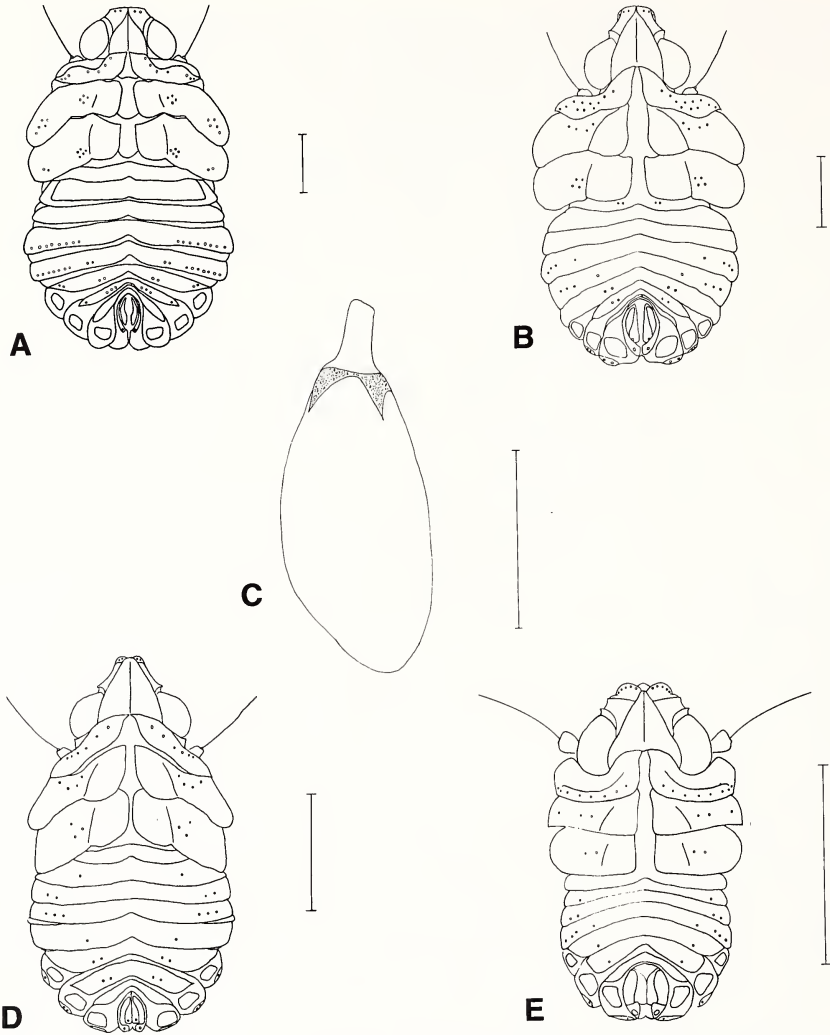


Fig. 4. *Phylloscelis pallescens* immature stages. A. Fourth instar. B. Third instar. C. Egg. D. Second Instar. E. First instar. Bars = 1 mm.

Abdominal tergites each with the following number of pits on either side of mid-line (lateralmost pits not visible in dorsal view): tergite 4 with 7 pits, tergite 5 with 9 pits, tergite 6 with 6 pits, tergite 7 with 5 pits, tergite 8 with 3 pits, and tergite 9 with 1 pit.

Second Instar (Figs. 4D, 5). Length 1.61 ± 0.02 ; thoracic length 0.81 ± 0.01 ; width 0.88 ± 0.02 . N = 10.

Vertex subequal in length and width. Anteclypeus with no cream spots, medial carina with a thin cream colored strip. Antennal pedicel with 5 pits.

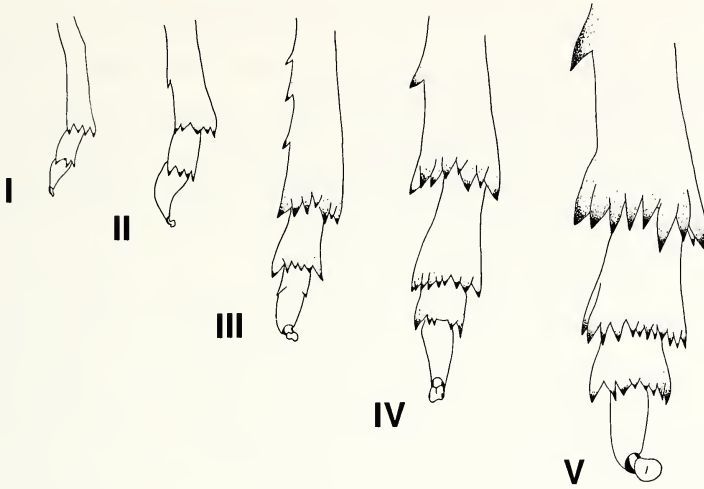


Fig. 5. *Phylloscelis pallescens* apices of metathoracic legs, plantar surface. I-V = nymphal instars.

Pronotal plates each with ca. 12 pits in 1 irregular row, ventrolateral surface with 5 pits. Mesonotum with cluster of 3 pits on each side just lateral to carina, each wingpad with 3 pits. Metanotum with cluster of 3 pits on each side just lateral to carina. Profemora less foliose; protibiae not foliose. Metatibia with an apical transverse row of 5 spines on plantar surface. Metatarsomere 2 with an apical transverse row of 6 spines on plantar surface; tarsomere 1 similar to tarsomeres of other legs.

Abdominal tergites each with the following number of pits on either side of mid-line (lateralmost pits not visible in dorsal view): tergite 4 with 6 pits, tergite 5 with 6 pits, tergite 6 with 5 pits, tergite 7 with 4 pits, tergite 8 with 2 pits, and tergite 9 with 1 pit.

First Instar (Figs. 4E, 5). Length 0.86 ± 0.01 ; thoracic length 0.48 ± 0.01 ; width 0.49 ± 0.02 . N = 6.

Antennal pedicel with 3 pits.

Pronotal plates each with ca. 10 pits, ventrolateral surface with 4 pits. Mesonotum with 2 pits on each side just lateral to carinal; each wingpad with 2 pits, no overlap of metanotal wingpad. Metanotum with 2 pits on each side just lateral to carina. Metatibia with an apical transverse row of 4 spines. Metatarsomere 1 with an apical transverse row of 4 spines.

Abdominal tergites each with the following number of pits on either side of mid-line (lateralmost pits not visible in dorsal view): tergite 4 with 4 pits, tergite 5 with 5 pits, tergite 6 with 3 pits, tergite 7 with 3 pits, tergite 8 with 1 pit, and tergite 9 with 1 pit.

Egg (Fig. 4C). Length 1.04 ± 0.01 ; width 0.42 ± 0.01 . N = 8.

Eggs elongate, oval: cream white: chorion translucent, cephalic end with short cylindrical process.

KEY TO *P. PALLESCENS* NYMPHAL INSTARS

1. Anteclypeus with 4 regular rows of cream spots; metatarsi with 3 tarsomeres; mesonotal wingpad covering $\frac{1}{3}$ or more of metanotal wingpad 2
 - Anteclypeus lacking rows of cream spots; metatarsi with 2 tarsomeres; mesonotal wingpad covering $\frac{1}{4}$ or less of metanotal wingpad 3
2. More than 28 pits between each inner and outer carina of frons; anteclypeus with 4 regular rows of cream spots, each row with 4 to 5 spots; tarsomere 1 with 10-12 spines; tarsomere 2 with 7-8 spines; mesonotal wingpad extends to near apex of metanotal wingpad (Figs. 2, 3, 5) 5th Instar
 - Fewer than 28 pits between each inner and outer carina of frons; anteclypeus with 4 regular rows of cream spots, each row with 3 spots; tarsomere 1 with 9-10 spines; tarsomere 2 with 5 spines; mesonotal wingpad covering $\frac{1}{3}$ metanotal wingpad (Figs. 4A, 5) 4th Instar
3. Pronotal plates each with ca. 17-18 pits in 2 irregular rows; vertex broader than long in dorsal view; metatibia with apical row of 7 spines on plantar surface; tarsomere 1 with 8 spines; tarsomere 2 with 2-3 spines (Figs. 4B, 5) 3rd Instar
 - Pronotal plates each with 12 or fewer pits in 1 irregular row; vertex subequal in length and width in dorsal view; metatibia with apical row of 5 or fewer spines on plantar surface; tarsomere 1 with 6 or fewer spines; tarsomere 2 without spines 4
4. Pronotal plates each with 12 pits; metatibia with apical row of 5 spines on plantar surface; tarsomere 1 with 6 spines (Figs. 4D, 5) 2nd Instar
 - Pronotal plates each with 10 pits in 1 irregular row; metatibia with apical row of 3-4 spines on plantar surface; tarsomere 1 with 4 spines (Figs. 4E, 5) 1st Instar

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